Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602890F: *High Energy Laser Research*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	47.939	53.229	53.384	0.000	53.384	54.059	52.297	54.174	55.038	Continuing	Continuing
625096: *High Energy Laser Research*	47.939	53.229	53.384	0.000	53.384	54.059	52.297	54.174	55.038	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the HEL Joint Technology Office (JTO). HEL weapon systems have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase; defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles; and the ultra-precision negation of targets in urban environments with no/little collateral damage. This program is part of an overall DoD HEL Science and Technology program. In general, efforts funded under this program are chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complimenting Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as chemical lasers, solid state lasers, free electron lasers, laser beam control, and laser lethality mechanisms. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	49.268	52.754	0.000	0.000	0.000
Current President's Budget	47.939	53.229	53.384	0.000	53.384
Total Adjustments	-1.329	0.475	53.384	0.000	53.384
• Congressional General Reductions		-6.100			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.225			
• Congressional Adds		6.800			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-1.329	0.000	53.384	0.000	53.384

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Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 625096: *High Energy Laser Research*		
Congressional Add: *Advanced Deformable Mirrors for High Energy Laser Weapons.*	0.000	1.593
Congressional Add: *High Bandwidth, High Energy Storage, Exawatt Laser Glass Development.*	0.000	2.788
Congressional Add: *Planar Lightwave Circuit Development for High Power Military Laser Applications.*	0.000	2.390
Congressional Add Subtotals for Project: 625096	0.000	6.771
Congressional Add Totals for all Projects	0.000	6.771

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added $1.6 million for Advanced Deformable Mirrors for High Energy Laser Weapons, $2.8 million for High Bandwidth, High Energy Storage, Exawatt Laser Glass Development, and $2.4 million for Planar Lightwave Circuit Development for High Power Military Laser Applications.

C. Performance Metrics
Under Development.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602890F: *High Energy Laser Research*	PROJECT 625096: *High Energy Laser Research*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625096: *High Energy Laser Research*	47.939	53.229	53.384	0.000	53.384	54.059	52.297	54.174	55.038	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the HEL Joint Technology Office (JTO). HEL weapon systems have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase; defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles; and the ultra-precision negation of targets in urban environments with no/little collateral damage. This program is part of an overall DoD HEL Science and Technology program. In general, efforts funded under this program are chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complimenting Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as chemical lasers, solid state lasers, free electron lasers, laser beam control, and laser lethality mechanisms. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Advance solid-state laser development.	8.000	12.605	13.764	0.000	13.764
FY 2009 Accomplishments: In FY 2009: Demonstrated over 100 kilowatts (kW) from the Joint High Power Solid State Laser (JHPSSL) laboratory. Verified performance through independent government-sponsored measurements. Initiated a joint-high power electric laser product improvement program that emphasizes efficiency, affordability, and ruggedization.					
FY 2010 Plans: In FY 2010: Conduct a joint-high power electric laser product improvement program. Begin translation of efficiency improvements into size, weight and packing reductions.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Conduct a joint-high power electric laser product improvement program. Prepare for government-sponsored measurements to validate performance. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Mature solid state laser device technologies that will provide improve system level performance. *FY 2009 Accomplishments:* In FY 2009: Developed power scaling architecture with good beam quality and reduced size and weight. Improved the efficiency and reliability of diode pump sources. Continued testing laser module combination concepts on testbed. Conducted Service and Agency proposal call for FY 2009. *FY 2010 Plans:* In FY 2010: Combine high performance single modules in optimum module combination schemes to demonstrate the path to weapons-class scaling. Continue development of high reliability diode pump sources and fiber laser components. Investigate eye-safer laser technologies and high efficiency architectures. Conduct an industry proposal call for FY 2010. *FY 2011 Base Plans:* In FY 2011: Demonstrate building block for highly efficient, compact, modular laser system with weapons-class applications. Demonstrate high reliability of diode pump sources. Scale eye-safer laser technologies to higher powers. Conduct Service and Agency proposal call for FY 2011. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A	8.708	9.479	9.830	0.000	9.830
MAJOR THRUST: Investigate new technologies that have revolutionary potential for HEL applications.	4.520	4.601	7.790	0.000	7.790

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Developed materials with improved thermo-mechanical properties. Demonstrated short pulse laser technologies in a laboratory environment. Demonstrated novel beam control concepts. Investigated new laser materials for direct lasing in different wavelength regimes. Conducted a Service and Agency proposal call for FY 2009, awarded new effort. *FY 2010 Plans:* In FY 2010: Incorporate new materials into a laser device and demonstrate properties in terms of wavelength selection, thermal handling, and overall laser efficiency. Scale short pulse laser technologies for military applications. Investigate advanced hybrid laser concepts and innovative beam phase control techniques. Conduct an industry proposal call for FY 2010. *FY 2011 Base Plans:* In FY 2011: Explore novel laser technologies to improve efficiency and decrease mass/volume. Demonstrate applications for short pulse laser technology. Scale electrically pumped alkali lasers to moderate power levels. Conduct a Service and Agency proposal call for FY 2011. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Conduct system level technology development and trade studies to facilitate scaling free electron lasers (FELs) to weapons-class power levels and shipboard integration. *FY 2009 Accomplishments:* In FY 2009: Completed prototype FEL demonstration activities. Investigated the development path for scaling to a 100 kW lab demonstration with emphasis on technologies that can support one megawatt (MW) future FEL performance. Conducted a Service and Agency proposal call for FY 2009, awarded three new efforts.	7.210	4.249	4.460	0.000	4.460

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2010 Plans: In FY 2010: Continue the development path for scaling to a 100 kW lab demonstration with emphasis on technologies that can support one MW future FEL performance. Conduct an industry proposal call for FY 2010. *FY 2011 Base Plans:* In FY 2011: Demonstrate scaling to a 100 KW lab demonstration, with emphasis on technologies that can support one MW future FEL performance. Conduct a Service and Agency proposal call for FY 2011. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Conduct technology experiments to select promising diode-pumped alkali lasers and chemical laser technologies that can be scaled for strategic weapons application. *FY 2009 Accomplishments:* In FY 2009: Investigated alternate chemical processes and high pressure operations concepts. Developed concepts for gas lasing materials with high efficiency. Investigated power scaling potential of direct excitation gas lasers. Conducted a Service and Agency proposal call for FY 2009, awarded six new efforts. *FY 2010 Plans:* In FY 2010: Effort terminated. *FY 2011 Base Plans:* In FY 2011: Not Applicable.	6.160	0.000	0.000	0.000	0.000

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: N/A					
MAJOR THRUST: Develop technology to support high performance beam control systems and integrated demonstrations. *FY 2009 Accomplishments:* In FY 2009: Developed/provided beam control technology options for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems). Investigated technologies to compensate for negative effects of atmosphere and platform vibration. Conducted a Service and Agency proposal call for FY 2009, awarded ten new efforts. *FY 2010 Plans:* In FY 2010: Demonstrate advanced component and control techniques for difficult environments, such as high speed flight, high turbulence, and extended ranges. Conduct an industry proposal call for FY 2010. *FY 2011 Base Plans:* In FY 2011: Implement beam control technology options for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Conduct a Service and Agency proposal call for FY 2011. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A	9.490	9.626	9.980	0.000	9.980
MAJOR THRUST: Conduct laser vulnerability experiments on materials, components, and targets. Develop a lethality database, and integrate into a systems-level architecture plan and lethality models.	3.851	4.053	4.640	0.000	4.640

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Developed databases that will be accepted by the HEL community and integrated into validated models for laser systems designers. Conducted laser vulnerability experiments on materials, components, and targets. Updated laser systems inputs for the Joint Munitions Effect Manual. *FY 2010 Plans:* In FY 2010: In close coordination with existing HEL models, integrate lethality data into campaign-level HEL system models. Conduct laser vulnerability experiments on materials, components, and targets. Update laser systems inputs for the Joint Munitions Effect Manual. *FY 2011 Base Plans:* In FY 2011: In close coordination with existing HEL models, integrate lethality data into campaign-level HEL system models. Conduct laser vulnerability experiments on materials, components, and targets. Update laser systems inputs for the Joint Munitions Effect Manual. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Maintain and evaluate high-fidelity engineering models for HEL scenario evaluation. Provide for HEL system modeling for into mission-level wargaming activities. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Complete, test, and demonstrate solid state laser model. Complete HEL system scenario model and demonstrate engagement applications. Develop scaling laws for atmospheric compensation components.	0.000	1.845	2.920	0.000	2.920

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Provide maintenance, verification, validation, and accreditation for updated system level HEL models. Conduct mission-level HEL engagement scenarios and wargame HEL concepts. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	47.939	46.458	53.384	0.000	53.384

	FY 2009	FY 2010
Congressional Add: Advanced Deformable Mirrors for High Energy Laser Weapons. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally-directed effort for Advanced Deformable Mirrors for High Energy Laser Weapons.	0.000	1.593
Congressional Add: High Bandwidth, High Energy Storage, Exawatt Laser Glass Development. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally-directed effort for High Bandwidth, High Energy Storage, Exawatt Laser Glass Development.	0.000	2.788

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
Congressional Add: Planar Lightwave Circuit Development for High Power Military Laser Applications. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally-directed effort for Planar Lightwave Circuit Development for High Power Military Laser Applications.	0.000	2.390
Congressional Adds Subtotals	0.000	6.771

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601108F: *High Energy Laser Research Initiatives.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603444F: *Maui Space Surveillance System.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: *Advanced Weapons Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: *High Energy Laser Advanced Technology Program.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: *Ballistic Missile Defense Boost Phase Segment.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: *Directed Energy Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: *Advanced Weapons Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602114N: *Power Projection Applied Research.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: *Sensors and Electronic Survivability.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: *Weapons and Munitions Advanced Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: *Tactical Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: *Ballistic Missile Defense Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M: *Joint Non-Lethal Weapons Applied Research.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603651M: *Joint Non-Lethal Weapons Technology Development.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.